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U. S. DEPARTMENT OF COMMERCE

PUBLIC DOCUMENT
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DETROIT
TECHNICAL NEWS BULLETIN
OF THE BUREAU OF STANDARDS

ISSUED MONTHLY

Washington, August, 1930—No. 160

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**FIRE PREVENTION AND PROTECTION
IN GOVERNMENT BUILDINGS**

Recent fires in Government buildings caused considerable newspaper comment relative to the degree to which precautions are being taken to provide safety for the buildings, their occupants, record storage, and other valuable contents. While the fire record for Government buildings has been, in general, comparatively favorable, it is known that hazards exist in them that may cause loss of life, valuable records, and large damage to structures that often are of monumental type.

Realizing this situation, representatives of the different departments and establishments at a meeting called by the Secretary of Commerce formed an organization to function in informative and advisory capacity on matters of fire prevention and protection arising in connection with Government activities. This includes such subjects as exit requirements for buildings, protection of records, elimination of fire hazards, fire detecting and extinguishing equipment, and fire alarm and patrol service, in so far as not covered by other interdepartmental agencies. It was further decided that the given organization should serve as a means of contact between the agencies within the different Government units that are charged with similar activities.

The group, later organized as the Federal Fire Council with the Director of

the Bureau of Standards as chairman, functions through committees of which one on fire hazards and another on apparatus and devices have been organized. Committees on inspection and interdepartmental cooperation, and on fire record have been authorized but not as yet fully organized. While the period since the first meeting last April has been mainly given over to organization and other preparatory details several requests for assistance have received attention. These include a preliminary survey of 12 institutions under the control of the board of public welfare of the District of Columbia, with report giving recommendations for structural betterment and installation of fire protective equipment. Consideration was also given to the protection required for the Patent Office records in the new Commerce Building.

**FURNACE FOR FIRE TESTS OF WALLS
AND PARTITIONS**

A new furnace for conducting fire tests of wall and partition constructions has been completed to replace one that had been in use for a number of years. An appropriation of \$22,000 was granted for moving the structural framing of the old shelter and furnace to the new location and for their reerection with suitable inclosure. The walls, roof, and floor of the new shelter are of reinforced concrete designed to withstand accidental explosive pressure from within of

600 lbs./ft.² before failure occurs. Window openings on three sides, filled with steel sash and plain glass, cover about 30 per cent of the wall area, and it is expected that the window construction will be forced out before pressures of 60 lbs./ft.² are developed, and thus relieve the pressure within the building before attaining intensities that would cause collapse of main structural members. The fuel used in the furnace is gas, and while safety measures have been incorporated in the installation to make remote occurrence of explosive mixtures or explosions within the inclosure and the furnace, it was nevertheless deemed advisable to provide the given structural features. The added cost over ordinary construction was quite small and was incurred mainly in properly disposing the reinforcing steel, providing brackets on beams and wide fillets or splays on the interior sections of columns to give the needed tensional resistance. Tensional resistance in the opposite direction must also be provided to resist stresses from rebound after high pressure from the inside. Provision must also be made to resist the uplift by means of floor reinforcement and proper design of foundation.

That extreme proportions of members are not required to attain the higher resistance outlined above is shown by the fact that walls are only 8 inches thick for center to center distance between columns of 26 feet, and the roof slab is 4 inches thick supported on 12 by 14 inch beams, 5 feet apart, and spanning a maximum distance of 29 feet 8 inches, center to center of trusses. It is believed that similar principles of design can be applied to advantage in designing commercial and industrial buildings in which explosive pressures may occur. The life loss from such explosions is caused more generally by the accompanying building collapse than by direct temperature and force effects. Wood, masonry, and concrete buildings as ordinarily constructed can generally not withstand pressures over 100 lbs./ft.² before collapse occurs.

The furnace is designed to accommodate specimens 10 to 11 feet high, and 16 feet wide. The walls or partitions to be tested are built within heavy movable frames and are placed for the fire test so as to form one side of the furnace chamber. Partitions and walls are tested either restrained and nonbearing to stimulate conditions where they are built between heavy columns and floor members in fire-resistive buildings, or they are tested under nominal working loads. In the present equipment the load is applied by means of four hydraulic jacks resting on the bottom mem-

ber of the restraining frame and supporting a steel member on which the construction to be tested is built. Loads up to 400,000 pounds can be applied before, during, or after the fire, or fire and water test. In addition, heavy walls are tested unrestrained, a condition obtained by leaving a space at the sides and top between the containing frame and the wall to be tested. This allows the wall full freedom to expand and deflect and simulates conditions for walls in the top story and also in lower stories where the interior framing is light and not anchored to the wall.

The fire exposure is obtained by means of 92 Venturi tube induction-type burners distributed over the back of the chamber opposite the wall to be tested. The design of these burners was developed for the requirements presented by this furnace, which include uniformity of temperature over the test wall with absence of directly impinging flames. In these burners the air required for combustion is drawn in at the cold end of the burner by the gas jet without aid of air compressor or fan. The large gas consumption, 16,000 to 20,000 cubic feet per hour, necessitated a new gas connection to the street main and a gas booster in order that this amount might be delivered to the burners at the required pressure.

SEAMS FOR COPPER ROOFING

Sheet copper has been used as a roofing material for hundreds of years. In the course of this time some five or six types of seams for joining the sheets have been proved by experience to be suitable for copper roofing. Two of these types formed the main subject of an investigation recently completed by the bureau.

On many old buildings with copper roofs the seams are calked with a white lead and linseed-oil mixture. A notable example is the statehouse in Boston. Although these calked seams have given very satisfactory service, an exact measure of their waterproof qualities has not previously been made. Leakage tests on both new and old seams showed that this type of seam can be used wherever the depth of water which may remain standing for several days on the roof will not exceed 4 inches. This depth rarely occurs except in gutters. A small section of seam removed from a roof after many years of service stood continuously for 45 days under 12 inches of water without any signs of leaking.

Many divergent opinions concerning soldered seams are held by experienced roofers. An elaborate series of tensile tests on 800 specimens was made in order

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to settle the question in issue and show how to obtain the strongest seams. Most roofers will use only killed acid flux. While this may possibly be justified from the standpoint of convenience in soldering, the tests showed that resin flux and a prepared commercial flux gave equally strong seams. Perhaps the most disputed point is the question whether flat-lock seams require large amounts of solder on the upper surface in order to give the maximum strength. It was found that the strength was increased by using larger quantities of solder, but the increase was slight. However, by pretinning—that is, dipping the edges of the sheets to be joined in flux and then in molten solder or tin—the maximum strength was obtained. Pretinned seams were very much stronger than those not pretinned even though made with large amounts of solder.

Another question is the effect of continuous load on a soldered seam. This was studied by suspending heavy loads from small sections of seams for periods of less than 1 to nearly 300 days. The results indicate that a soldered lap seam can sustain a load of about 350 lbs./in.² of seam indefinitely without failure. The limit for pretinned one-half inch flat lock seams was found to be about 375 lbs./in.². These values can be employed to design seams for the conditions under which they are to be used. The bureau recommends that a factor of safety be adopted, since it is not possible properly to inspect a finished seam.

This investigation will be more fully described in the September number of the Bureau of Standards Journal of Research.

WELDED COLUMN BASES

Fusion welding is coming into use for fabricating steel structures. One field where this process can be used to advantage is to join the comparatively small pieces required for the base of a column. The base is necessary to distribute the load carried by the column over the weaker concrete footing. If the base is fabricated by riveting, it is necessary to use eight or nine short pieces of rolled angles or plates. Only three pieces of rolled plate are needed for the welded base.

Tests made at the bureau in cooperation with the American Bridge Co. showed that the welded base was practically as strong as the strongest type of riveted base. As the welded base is believed to be both lighter and cheaper, this modern method of fabricating steel will probably be used extensively in the future for making columns for the subways in our large cities.

This work will be discussed in greater detail in the September number of the Bureau of Standards Journal of Research.

WIND PRESSURE ON CHIMNEYS

One of the major elements determining the cost of a large chimney or stack is the amount of wind pressure which it is to withstand. Many specifications are drawn up in which the chimney is required to withstand a wind of 100 miles per hour, but since there are all sorts of opinions and little knowledge as to the pressures imposed by a wind of this amount, different bidders often design for different loads and therefore do not bid on structures of the same strength. In many instances it is felt that the values of wind pressure used are too high, thus increasing the cost without corresponding benefit.

For several years an investigation of the wind pressure on chimneys and other cylindrical structures has been in progress at the bureau. Model testing in wind tunnels does not give a satisfactory answer in this instance, and it has been necessary to supplement these tests by measurements on large structures in natural winds. The investigation showed that the wind pressure is a function of the ratio of the height of the chimney to its diameter and that a wind pressure corresponding to 20 lbs./ft.² of projected area at a wind speed of 100 miles per hour is a safe value to use in designing chimneys of which the exposed height does not exceed ten times the diameter.

This investigation will be discussed at greater length in the September number of the Bureau of Standards Journal of Research.

CONSTRUCTION ACTIVITY DURING MAY, 1930

The value of construction contracts awarded in 37 States during May, 1930, as reported by the F. W. Dodge Corporation, amounted to \$457,416,000, a decrease of 22 per cent as compared with May, 1929, when contracts were valued at \$587,766,000.

Contracts awarded for public works and utilities and nonresidential construction for the first five months of 1930 are about equal to the corresponding period of 1929, and substantially larger than the 1925-1929 average. However, residential contracts during the first five months fell to about one-half those during the same period last year. This brought the total contracts for the first five months 18 per cent below the same period in 1929.

CHANGES IN VOLUME OF BURNED CLAY BODIES

The Columbus branch of the bureau is conducting an investigation of the change in volume of burned clay bodies resulting from the autoclave treatment, and is comparing this change with that produced by actual weathering outdoors and storing in a damp jar over water. Five bars of each of several commercially fired bodies were subjected to a 3-hour autoclave treatment under a steam pressure of 150 lbs./in.² and their changes in length noted. The absorptions of these bars were determined after the autoclave treatment. A corresponding set of five bars of each body was placed on a single story roof outdoors and another set was placed in a closed container over water. The changes in length of these bars as recorded after the first six months (from June to December) and after the second six months (from December to June) are given below with each value representing the averages of the five bars.

A buff wall tile body expanded 0.057 per cent in the autoclave; 0.016 per cent in 6 months outdoors; 0.009 per cent in 6 months in a damp jar; 0.032 per cent in 12 months outdoors; and 0.025 per cent in 12 months in a damp jar; and had an absorption of 6.6 per cent.

A white wall tile body expanded 0.069 per cent in the autoclave; 0.053 per cent in 6 months outdoors; 0.053 per cent in 6 months in a damp jar; 0.053 per cent in 12 months outdoors; and 0.070 per cent in 12 months in a damp jar; and had an absorption of 15 per cent.

A soft fired terra cotta body expanded 0.056 per cent in the autoclave; 0.030 per cent in 6 months outdoors; 0.025 per cent in 6 months in a damp jar; 0.034 per cent in 12 months outdoors; and 0.043 per cent in 12 months in a damp jar; and had an absorption of 12.5 per cent.

A white semivitreous dinner-ware body expanded 0.071 per cent in the autoclave; 0.063 per cent in 6 months outdoors; 0.053 per cent in 6 months in a damp jar; 0.072 per cent in 12 months outdoors; and 0.076 per cent in 12 months in a damp jar; and had an absorption of 9.6 per cent.

An ivory semivitreous dinner-ware body expanded 0.065 per cent in the autoclave; 0.063 per cent in 6 months outdoors; 0.048 per cent in 6 months in a damp jar; 0.086 per cent in 12 months outdoors; and 0.078 per cent in 12 months in a damp jar; and had an absorption of 7.8 per cent.

EFFECT OF VARIATIONS IN COMPOSITION ON PROPERTIES OF VITREOUS ENAMELS

It is customary to express the compositions of enamels in terms of the percentages of the various constituents (mostly oxides), no attempt being made to indicate the actual chemical constitution, for lack of knowledge on that point. There is considerable evidence, however, that enamels which have virtually identical ultimate chemical compositions may sometimes differ markedly in properties, provided different combinations of raw materials are used. Thus the sodium content of an enamel, customarily expressed as Na_2O , may be derived from the carbonate and the nitrate of soda, borax, feldspar, and other sodium-bearing raw materials. Obviously, the proportions in which these materials are used may be varied without disturbing the resultant sodium content of the enamel.

It was considered important to learn something more definite about the effects of variations in raw materials on the properties of enamels of given composition before attempting to correlate the compositions with quantitatively determined properties. Using analyzed raw materials, two enamels were prepared having the same calculated ultimate composition but different batch compositions. Cone deformation tests showed a distinct difference in fusibility between the two enamels. There was also a detectable difference in the indices of refraction. To indicate whether these differences might be due to a state of arrested reaction in one or both of the enamels, additional heat treatment was given in platinum crucibles at the temperature of preparation ($1,250^\circ\text{C}$). The initial melting occupied about 1 hour, and the additional treatment was carried out over periods of 4, 6, and 12 hours, respectively. The cone deformation temperature of each enamel remained virtually unchanged throughout these tests, and the indices of refraction were still different at the end of the 12-hour treatment. Hence, the difference in properties between the two enamels appears to be due to some more stable condition than mere arrested reaction. The compositions of the differently treated frits, as determined by chemical analysis, will have to be considered before drawing final conclusions.

Several samples of chrome ore are included in the bureau's investigation of the linear thermal expansion of special refractories to $1,800^\circ\text{C}$. Some data on expansion of Imperial (Rhodesian),

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African (friable), Grecian, and Indian chrome ores have been obtained. These ores all have the same characteristic expansion; namely, when tested from 20° to 1,000° C. in a neutral to oxidizing atmosphere, the rate of expansion of specimens fired at cone 23 (approximately 1,580° C.) is uniform throughout the entire temperature range, and the total expansion at 1,000° C. is between 0.7 and 0.85 per cent. However, under reducing conditions the rate of expansion increases greatly, and in the case of the African ore the increase is enormous. For comparative purposes the following table gives the average coefficient of linear thermal expansion from 20° to 1,000° C. of the materials in a (1) neutral to oxidizing atmosphere and in a (2) reducing atmosphere.

Kind of ore	Kind of atmosphere	
	Oxidizing	Reducing
Imperial.....	7.29×10^{-6}	17.45×10^{-6}
African.....	8.51×10^{-6}	39.01×10^{-6}
Grecian.....	8.32×10^{-6}	10.06×10^{-6}
Indian.....	7.29×10^{-6}	15.91×10^{-6}

The total expansion of the African ore was 4.8 per cent at 1,030° C. (reducing atmosphere.) After cooling it was found that the specimen had increased approximately 4.3 per cent in length.

The specimens of Imperial, Grecian, and Indian ores, which were heated in the testing apparatus to 1,800° C. (reducing atmosphere only), showed initial contraction at approximately 1,300° C. and contracted rapidly between 1,400° and 1,800° C. The maximum expansion of the Imperial ore was 1.93 per cent, obtained at 1,200° C.; the Grecian ore, 1.16 per cent, obtained also at 1,200° C.; and the Indian ore, 1.83 per cent, obtained at 1,300° C.

The specimen of Imperial ore fired at cone 23 and heated to 1,800° C. was tested a second time. The maximum expansion, 1.20 per cent, was obtained at 1,430° C. Although the specimen began to contract after reaching this temperature and continued to do so to 1,800° C., the rate of contraction was decidedly lower than in the initial test. At 1,800° C. the total expansion was 0.82 per cent. The average coefficient of expansion from 20° to 1,430° C. is 8.5×10^{-6} .

The petrographic examination of these ores after firing at cone 23 (1,580° C.) and after heating in a reducing atmosphere either to 1,000° C. or to 1,800° C. showed no change in composition.

ACCELERATED WEATHERING OF LETTER-BOX ENAMELS

Two samples of olive-green letter-box enamels were tested for durability for the Post Office Department. One showed bad checking within 14 days, while the other was free from checking or cracking within the same period. In purchasing this enamel the Post Office Department for the fiscal year beginning July 1, 1930, has adopted and has printed the accelerated method of test as a part of the specifications. This is the first Government department, so far as is known, to use this method of test as a printed requirement of their specifications. They require that 2-coat job of enamel, when exposed in the accelerated cycle (as used at the Bureau of Standards) for 14 continuous days, shall show no color fading, checking, cracking, chalking, and not over a slight loss of gloss. The preparation of the panels and the method of test are described in detail. These enamels are pigmented oleoresinous varnishes that are used on letter boxes out of doors. They must be very durable, and a chemical examination of the enamel, especially of the varnish vehicle, is of little use in predicting durability. The 14-day requirement that the coat of enamel shall be free from defects is based on a large number of exposure tests, both outdoors and in the accelerated test. The requirement is reasonably severe, so as to allow only high-grade enamels. In one exposure test 6 out of 22 enamels from as many different manufacturers passed the test.

DETERMINATION OF OSMIUM

It is believed that the new method for the determination of osmium (mentioned in Technical News Bulletins Nos. 156 and 157), as now completely developed, successfully overcomes the difficulties which have heretofore been experienced and offers a simple and accurate means for the determination of this metal.

The method may be briefly described as follows: Osmium tetroxide separated from other metals by distilling with nitric acid is absorbed in 6 N hydrochloric acid saturated with sulphur dioxide and contained in two receiving flasks attached to the distilling flask by ground joints. After the distillation is complete the receiving solution is transferred to a beaker and evaporated on the steam bath. The residue, which will not go quite to dryness because of the presence of sulphuric acid formed by oxidation of the sulphur dioxide by the osmium tetroxide and nitric acid which were distilled into the solution, is digested for 15 minutes with a small

amount of strong hydrochloric acid. The solution is again evaporated and the digestion with hydrochloric acid repeated. After evaporating once more the residue is diluted with water to about 150 ml and the solution heated to boiling. A few drops of brom phenol blue are added and then a dilute solution of sodium bicarbonate until the alkaline color of the indicator appears (about pH 4). At this alkalinity the osmium is completely precipitated as hydrated osmium dioxide, which is well coagulated on boiling for five minutes. The precipitate is filtered off on a Gooch or preferably a Munroe crucible and washed with hot 1 per cent ammonium chloride solution. After the washing is completed the residue is moistened with saturated ammonium chloride solution. This treatment completely prevents the tendency of the dioxide to deflagrate on subsequent ignition. The crucible is covered with a Rose lid and a slow stream of hydrogen introduced. Heating is done cautiously until the ammonium chloride has been volatilized, after which the crucible is heated to bright redness. Heating is continued at this temperature for a few minutes, after which the crucible is cooled in the current of hydrogen. When the crucible is at room temperature the current of hydrogen is displaced by a current of carbon dioxide, care being taken that no air is admitted. After the current of carbon dioxide has been passed for a few minutes the crucible is weighed. Osmium is thus weighed as metal and the results obtained with careful work are very precise.

DIMENSIONAL CHANGES IN GLASS RESULTING FROM HEATING CYCLES

In obtaining expansivity curves for a medium flint glass, samples of the glass were tested which had previously received one or another of several different heat treatments. In these tests heating cycles were employed which made it possible to determine the magnitude of the so-called permanent changes in length which are caused either by the annealing or the disannealing which may result from the heat treatment imposed on the glass by the heating cycles employed. Annealing decreases the length and specific volume, while disannealing increases them. These effects are related to certain ice-point shifts observed in thermometers, and to other effects sometimes observed in various types of glassware.

This investigation will be described in greater detail in the September number of the Bureau of Standards Journal of Research.

WEATHERING OF SPECIAL WINDOW GLASSES

Over 18 months ago the bureau called attention to the fact that the special window glasses which are used to transmit ultra-violet radiation undergo a greater decrease in transmission when exposed to the mercury arc than when exposed to the sun and that further exposure of these glasses to the sun, after exposure to the mercury lamp, increases the ultra-violet transmission to a higher value than the minimum attained by prolonged exposure only to the sun. This overshooting in transmission, which ranged from 1 to 6 per cent above the minimum attained by exposure only to sunlight, was found in 17 out of 20 samples of different makes of glass, including the most widely known glasses, such as Vitaglass and Helioglass. It was then indicated that a further investigation would be required to determine whether this condition would remain permanent on further exposure to the hot, summer sun. To this end the exposure of these glasses to the sun was continued and their transmissions determined in January and March, 1930.

During the past month further measurements were made on these glasses, showing that this overshooting in transmission is not permanent but increases to a maximum, after which it decreases again to a value that is closely the same as, or somewhat lower than, that attained by exposure only to the sun.

Experiments show that the decrease in transmission, caused by the action of ultra-violet radiation, can be counteracted by maintaining the glass at suitably high temperature. The rejuvenation tests, with sunlight transmitted through filters, show that wave lengths in the region of 365 to 400 m μ produce the greatest rejuvenation, but sufficient time has not yet elapsed to determine whether this will remain permanent.

ULTRA-VIOLET RADIATION FROM GAS STOVES

The ordinary gas stove, in which the clay radiants are heated to incandescence by means of Bunsen gas flames, is an excellent source of infra-red radiation. But owing to their low temperature these radiants, even when covered with special materials, claimed to emit ultra-violet, do not emit a sufficient amount of ultra-violet to merit consideration as a source of short wave length ultra-violet radiation useful for healing purposes.

This was established at the bureau by two independent methods of observation which were amply sensitive to detect ultra-violet radiation, if emitted. By

photographing the spectrum, it was established that the intensity of the ultra-violet emitted by a gas stove is less than 1/800000 that of similar ultra-violet wave lengths in sky radiation.

By means of a sodium in quartz photo-electric cell, it was found that at a distance of 50 cm from a radiant heater, the ultra-violet emitted was less than 1/100000 of the ultra-violet of wave lengths less than 313 $m\mu$ contained in noon hour June sunlight.

VALUE OF ADDITION AGENTS IN COPPER ELECTROTYPING SOLUTIONS

In the manufacture of copper electrotypes for the printing industry, various addition agents are used in the solutions in order to permit more rapid deposition and to produce harder deposits of copper. A recent investigation at the bureau has shown that of the substances which may be used for this purpose, phenol (carbolic acid) is most effective. When a small amount of this substance (in the form of a compound with sulphuric acid) is added to the solutions, deposits can be produced under favorable conditions in about one-fourth the time commonly used in electrotyping. Such deposits are also harder than those obtained without any addition agents and, therefore, will give better service on the printing presses.

This work will be described in detail in the September number of the Bureau of Standards Journal of Research.

PAPER-COATING MINERALS AND ADHESIVES

As a result of the interest manifested among manufacturers in the investigation on Use of Glue in Coated Paper (Technologic Paper No. 323) other paper-coating materials have recently been studied. The purpose of the investigation was to keep the public informed of new developments in raw materials and promote the use of domestic resources, which would become very important in the event of any disturbance limiting the supplies of foreign origin. In the later study 4 different coating clays, 2 foreign and 2 domestic, and 1 commercial compound of domestic diatomaceous earth were the minerals employed. Three types of high-grade commercial adhesives—casein, glue, and modified starches—were used. The tests were confined to papers suitable for high-grade printing. The coating procedure was similar to the commercial practice employed in applying a single coating to paper.

The clays worked satisfactorily with the different adhesives, the domestic clays comparing favorably with the

foreign, but the coating of diatomaceous earth did not adhere well to the paper. It was believed that the loss of adhesiveness was due to the high alkalinity of the mineral.

Relative to the comparative quality of the adhesives as paper-coating materials, the tests indicate that the starches may not have as good adhesive quality as casein or glue, but all coatings containing 18 parts of starch per 100 parts of clay were well bound to the body papers. Graded as to their clay suspending property the adhesives are rated in the following order: Starch, casein, and glue.

Printing tests of the papers were made at the Government Printing Office which used their regular half-tone process. Equally good results were obtained with the American and foreign clays, and with the three different kinds of adhesives. Both the starch and glue coatings, however, had less water resistance than the casein coatings and, therefore, would possibly not be suitable for lithographic processes requiring a high degree of water resistance.

A complete report of this investigation is being prepared for publication.

PREPARATION OF FIBER TEST SHEETS

The need in the paper-making research at the bureau for a laboratory test that is analogous to paper-mill processes has led to the construction of a suction sheet machine and the development of a method of preparing fiber sheets. The test procedure relates to the forming of the sheet on the mold and the subsequent operations of couching, pressing, and drying. A complete description of the equipment and technique employed in forming the sheets is given in the Bureau of Standards Journal of Research, Vol. 5, No. 1, p. 105; July, 1930 (Research Paper No. 190).

The construction of an agitator for defibering the pulp samples, and of a sheet mold, both of which were devised especially for use in making the test sheets, is described in detail. Experimental data are included on the relative efficiency of blotters and felts in removing the sheets from the wire screen on which they are formed and in absorbing the excess moisture from the sheets.

Test data on the finished papers show that the fibers are uniformly distributed in sheets made by the method described, and that the different sheets of a series made from a given sample of stock are in close agreement and can be duplicated as desired. The personal equation is reduced to a minimum and comparable results are obtained by different operators. The size of the finished sheets is

adequate to supply specimens for each kind of test ordinarily made to evaluate the quality of paper.

The results obtained warrant the view that the method is practical and is useful for mill control or paper-making research.

THE INFLUENCE OF SPLITTING ON THE STRENGTH OF LEATHER

In the manufacture and use of leather, splitting the hide in order to secure leather having a uniform and definite thickness is a common practice. Grain upholstery and upper leathers made from steer hides are examples of split leathers, the thickness of which represents from 25 to 35 per cent of the total thickness of the leather made from the hides.

In many other cases where approximately the full thickness of leather produced is used, it is often necessary to split off certain portions of the flesh fibers in order to obtain an even thickness. The effects of these splitting operations have been studied, and the results appear to explain the failure of some leathers in service.

A typical example is that of a sample of calf upper leather which tore when subjected to the tension of the lasting operations in the shoe factory. Microscopic examination revealed that the leather had been split so as to remove about one-half of the thickness of that originally produced.

Tests made on several samples of calf upper leather showed that grain splits varying in thickness from 20 to 37 per cent of that of the unsplit portions possessed from $3\frac{1}{2}$ to 12 per cent of the breaking strength of the unsplit portions. The breaking strength of the corresponding flesh splits varied from 54 to 70 per cent of that of the unsplit leathers. The results of the tests demonstrate that grain splits, ranging in thickness up to about 50 per cent of that of the unsplit leathers, have materially less strength than either the unsplit or flesh-split portions of the same leathers. A further serious effect of splitting is that the percentage stretch of grain splits, at a definite stress, is always much greater than for the unsplit leathers.

Although the removal of a certain amount of the strength-giving fibers from the flesh side of leather generally leaves a grain thickness having satisfactory strength properties for the service intended, the manufacturer of leather should maintain a careful check on the operation in order to avoid unnecessary failures of otherwise satisfactory ma-

terial when used for shoe uppers, straps, bags, upholstery, and transmission belting.

AERONAUTIC RADIO RESEARCH

Advantage was taken of the severe atmospheric prevalent at this time to determine the minimum power requirements for the runway localizing beacon transmitter. A distance range of approximately 10 miles is required for this beacon under all conditions of radio reception. A number of tests indicate that this distance range is secured, with some margin to spare, when using only 100 watts in each loop antenna, the corresponding power previously employed being 250 watts. This reduction in power considerably simplifies the transmitting circuit arrangement and reduces the cost of the localizing beacon installation by fully 25 per cent.

Further improvements were incorporated in the automatic volume-control device recently developed by the research division. This device operates to maintain constant receiving-set output signal intensity regardless of the magnitude of the input voltage. Its operation depends upon the rectification of the output voltage and the application of this rectified voltage as negative bias on the grids of the radio-frequency amplifying tubes of the receiving set. Any increase in the output voltage due to increasing input voltage is accompanied by an increase in this negative bias. This serves to reduce the sensitivity of the radio-frequency amplifying tubes, thereby maintaining substantially constant output voltage. Increasing input voltages are thus accompanied by increasing negative biasing voltage on the radio-frequency tubes. A d. c. milliammeter reading plate current supply will therefore show smaller deflections as the receiving-set input voltage is increased.

When flying on the visual type radio range beacon, this milliammeter may be used as an approximate distance indicator. As the distance of the airplane from the beacon is reduced the input voltage increases, thereby reducing the plate meter deflection. The reverse is true if the distance of the airplane from the beacon increases. Flight tests made on this device have demonstrated its possibilities, particularly on the runway localizing beacon used in the research division's blind-landing system. By virtue of its use as an approximate distance indicator it at once tells the pilot whether he is approaching or going away from the landing field.

NEW AND REVISED PUBLICATIONS
ISSUED DURING JULY, 1930Journal of Research¹

- Bureau of Standards Journal of Research, Volume 3 (RP Nos. 77 to 128), bound in cloth, \$2.75 (foreign, \$3.50).
Bureau of Standards Journal of Research, Vol. 5, No. 1, July, 1930 (RP Nos. 183 to 193, inclusive). Obtainable by subscription. (See footnote.)

Research Papers¹

(Reprints from Journal of Research)

- RP177. A gas analysis pipette for difficult absorptions; M. Shepherd. Price, 5 cents.
RP179. Blistering phenomena in the enameling of cast iron; A. I. Krynsky and W. N. Harrison. Price, 30 cents.

Simplified Practice Recommendations¹

- SPR51-29. (3d ed.) Die-head chasers (for self-opening and adjustable die heads). Price, 10 cents.

Commercial Standards¹

- CS20-30. Staple vitreous china plumbing fixtures. Price, 10 cents.

Commercial Standards Monthly¹

- CSM. Vol. 7, No. 1, July, 1930. Obtainable by subscription. See footnote.

Technical News Bulletin¹

- TNB160. Technical News Bulletin, August, 1930. Obtainable by subscription. See footnote.

OUTSIDE PUBLICATIONS

- Tests of coated pipe. Scott Ewing; American Gas Journal (New York, N. Y.), Vol. 132, No. 5, p. 52; May, 1930.
A new consistometer and its application to greases and to oils at low temperatures. R. Bulkley and F. G. Bitner; Journal Rheology (Lafayette College, Easton, Pa.), Vol. 1, No. 3, p. 269; April, 1930.

¹ Send orders for publications under this heading with remittance only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama; other countries, 40 cents). Subscription to Journal of Research, \$2.75; other countries, \$3.50. Subscription to Commercial Standards Monthly, \$1; other countries, \$1.25.

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